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Service Oriented Architecture for the Next Generation Air Transportation System

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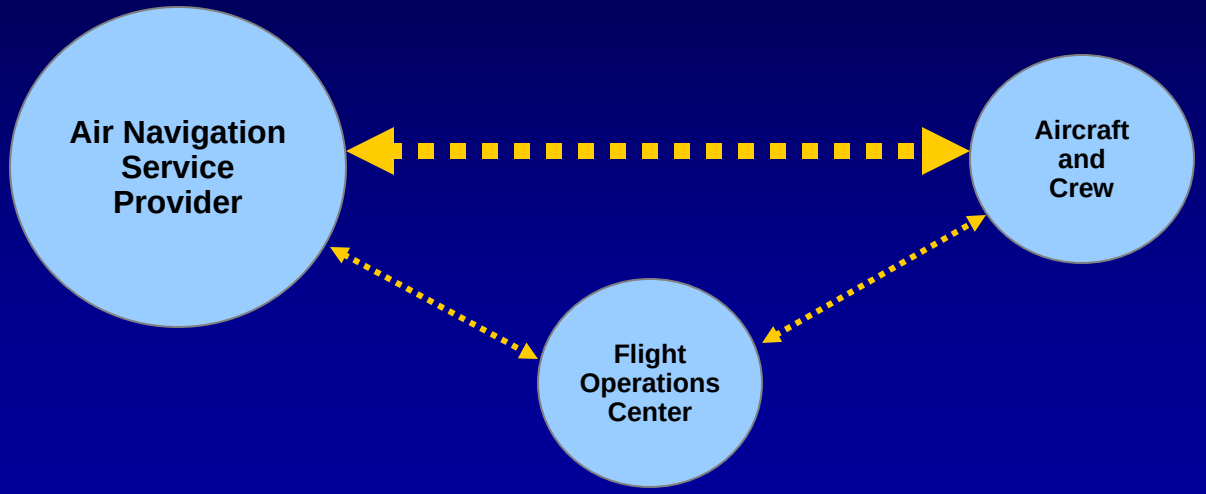
Agenda

- *Next Generation Air Transportation (NEXTGEN) Challenges*
- *Service Oriented Architecture (SOA) Concepts*
- *Analysis and Synthesis Methodology*
- *Independent Research & Development (IRAD) Example Results*
- *Prototype Demonstration of Practical Applications*

NEXTGEN Challenges

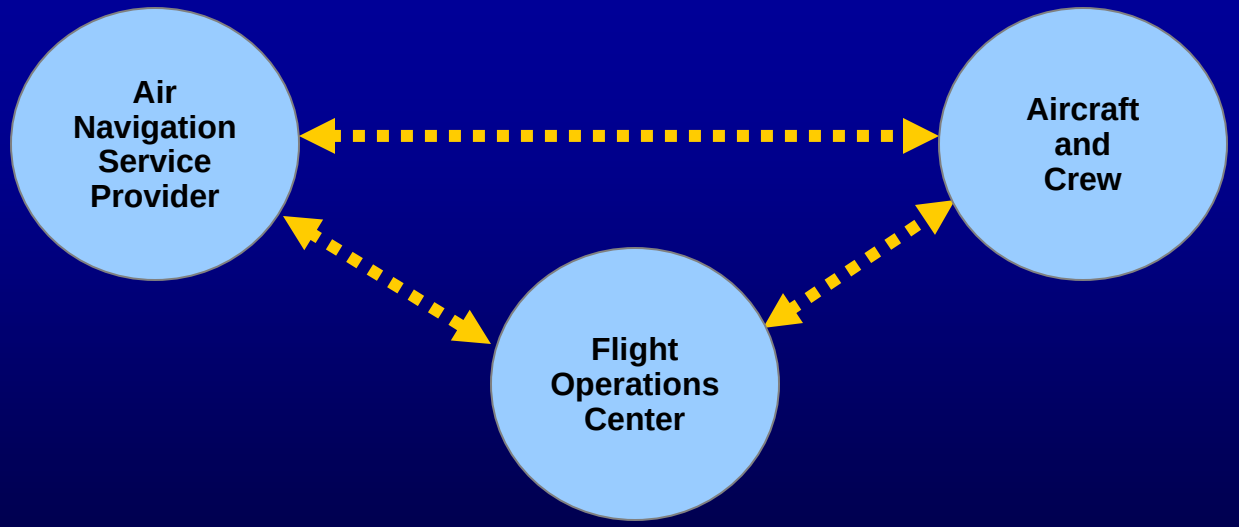
- ***Address Capacity Demands***
- ***Enhance Safety and Security***
- ***Improve Common Situational Awareness***
- ***Enable Flexible Allocation of Workload***
- ***Facilitate Agile Evolution of Automation***

Decision Making Roles



TODAY

NEXTGEN

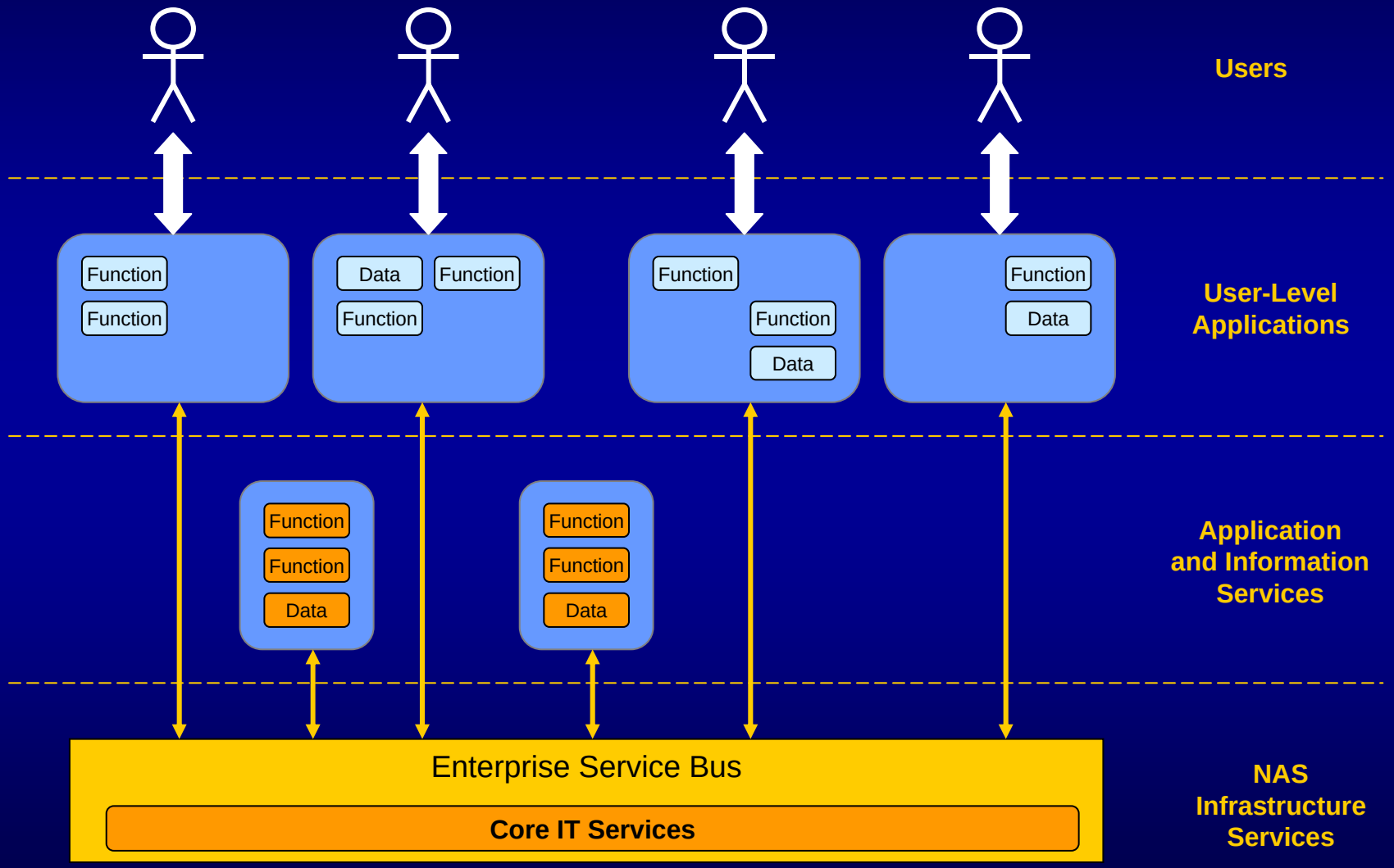


Service Oriented Architecture (SOA)

- ***Attributes***
  - *Loosely Coupled Modular Components*
  - *Well Defined and Visible Interfaces – Services*
  - *Implementation Independent Service Definitions*
  - *Supported by Existing and Emerging Standards*
  - *Enterprise Service Bus Based Infrastructure*
  - *Enterprise Oriented Perspective*

- ***Benefits***
  - *Agile and Responsive to Change*
  - *Reduced Cost of Ownership*
  - *Ease of Maintenance*

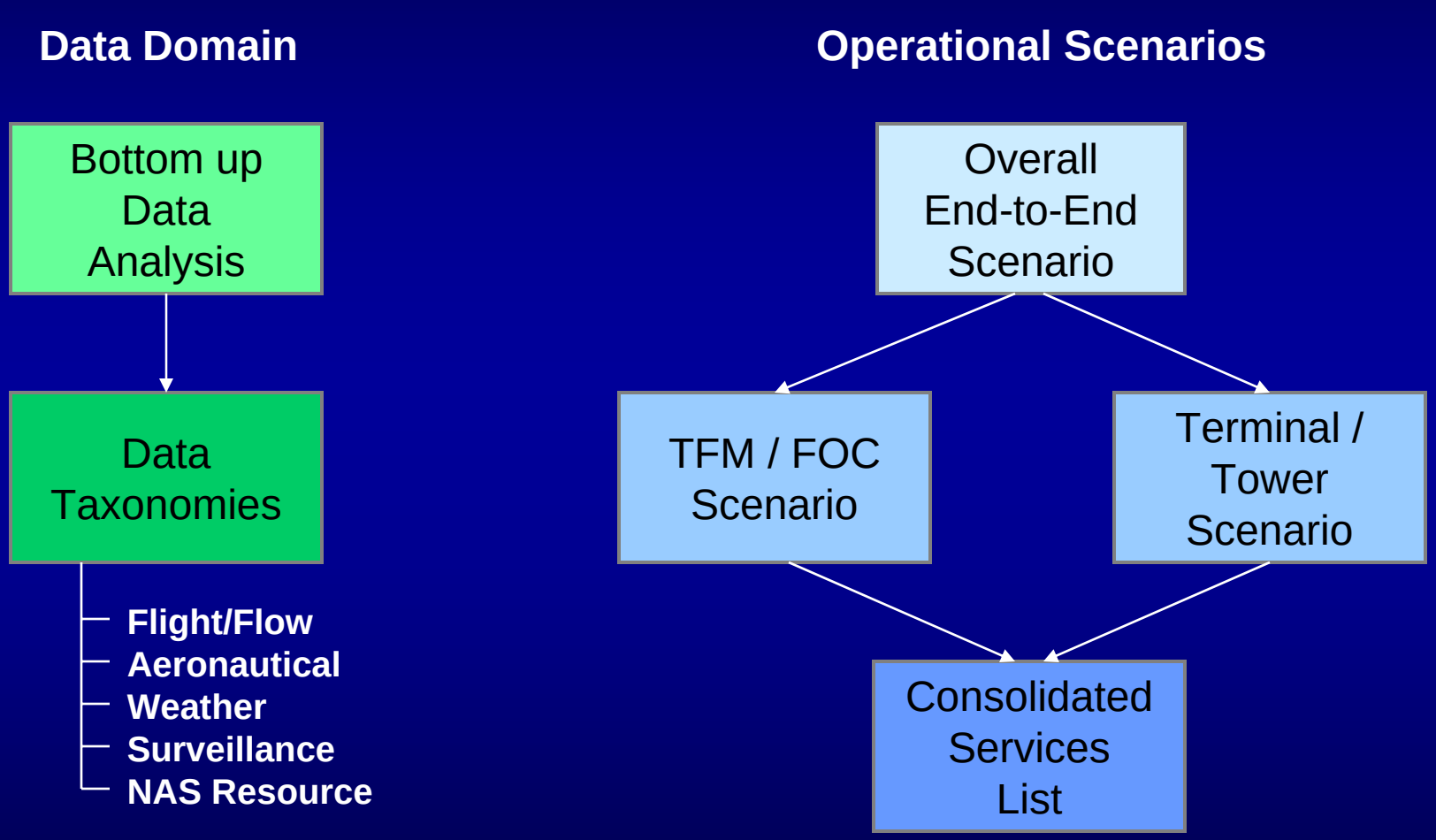
Layered SOA Architecture



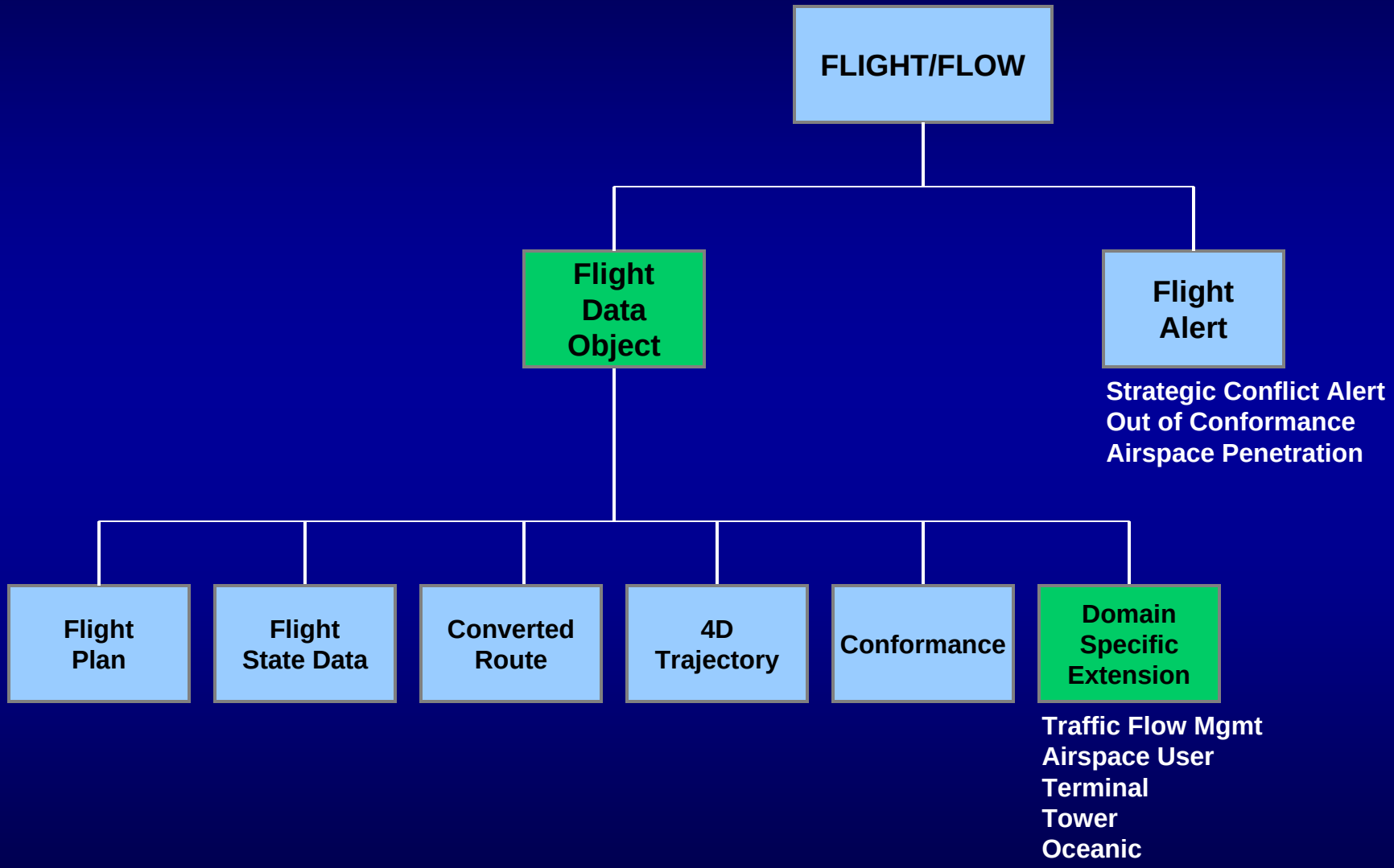
Basic Data Types

- ***Surveillance - information related to detection, tracking, characterization, and observation of aircraft and other vehicles for the purpose of conducting flight operations in a safe and efficient manner***
- ***Flight/Flow - information that establishes flight identity, aircraft equipage, intended route of flight, the corresponding 4 dimensional trajectory, and the degree to which the flight's actual movement conforms with its stated intent***
- ***Weather - information characterizing the observed and forecast meteorological conditions that may be relevant to current and planned flight operations***
- ***Aeronautical – information defining the structure, characteristics, and status of the airspace and ground based infrastructure where relevant for current and planned flight operations***
- ***NAS Status - current and historical information regarding the status, behavior, and alert notifications for the resources, facilities, systems, equipment, interfaces, and services that constitute the NAS***

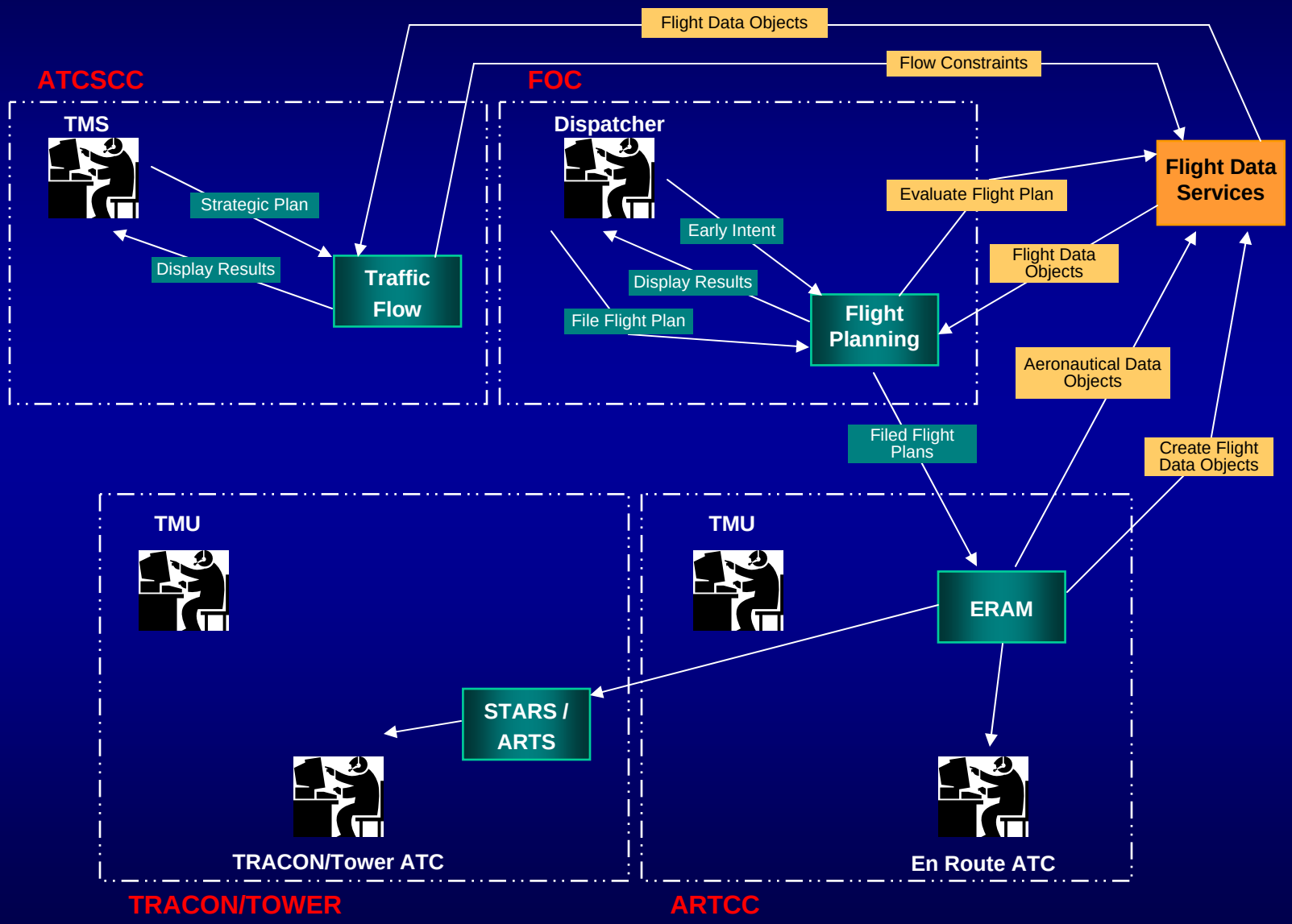
Analysis Work Products



Data Taxonomy Example



Scenario Example



Identified Services

- ***Evaluate Flight Plan***
- ***Create Flight Data Object***
- ***Flight Object Delivery (publish/subscribe)***
- ***Flow Constraint Delivery (publish/subscribe)***
- ***Aeronautical Data Delivery (publish/subscribe)***

Practical Application

- ***Prototype demonstration of SWIM enabled applications***

- ***SWIM Enabled Applications:***
  - *Prototype Flight Data Input/Output (FDIO) Application*
  - *Traffic Flow Management (TFM) Demand Calculator*
  - *Flight Plan Pre-Processor (FP3) Application*
  - *Special Use Airspace (SUA) Management*

- ***Key Services:***
  - *Flight Data Object Creation/Delivery*
  - *Evaluate Flight Plan*
  - *Aeronautical Data Delivery (SUA status, Pref Route status)*

Lab Physical Architecture

Standard URET components, enhanced with CPDLC application and to export and import data

URET (soon to be ERAM) components in an ESB "wrapper"

Standard Commercial Products provide messaging, security, scalability

Commercial Relational Databases

ZME ARTCC

En Route System

Radar Position

URET In a Box

Data Position

Data Repositories

Flight Data Core Services

Application Server

Database Server

Flight Data

Aero Data

Fp³ Services

Enterprise Service Bus (BEA's WebLogic)

URET In a Box

Data Position

En Route System

ZDC ARTCC

FDIO

Terminal/Tower System

RIC Tower

Fp³

Airline Services

Delta (DAL) AOC

Demand Calculator

TFM Services

ATCSCC

SAA Web Page

Military Dispatcher

Pax River Naval Air Station

Standard URET components, enhanced to export and import data

Java Clients subscribe to data from the Enterprise Service Bus

Summary

- *Efficient and flexible information sharing is critical to meeting both the near term objectives and longer term NEXTGEN challenges*
- *Service Oriented Architecture (SOA) concepts offer significant benefits in reduced cost of ownership, ease of maintenance, and flexibility to respond to evolving requirements*
- *Analysis and synthesis methodologies exist and can readily be employed to derive and define flexible services that support applications and users*
- *Practical application of SOA concepts is already feasible and being demonstrated today*

The essential motivation, technologies, and tools are already in place; all that remains is to make it happen …